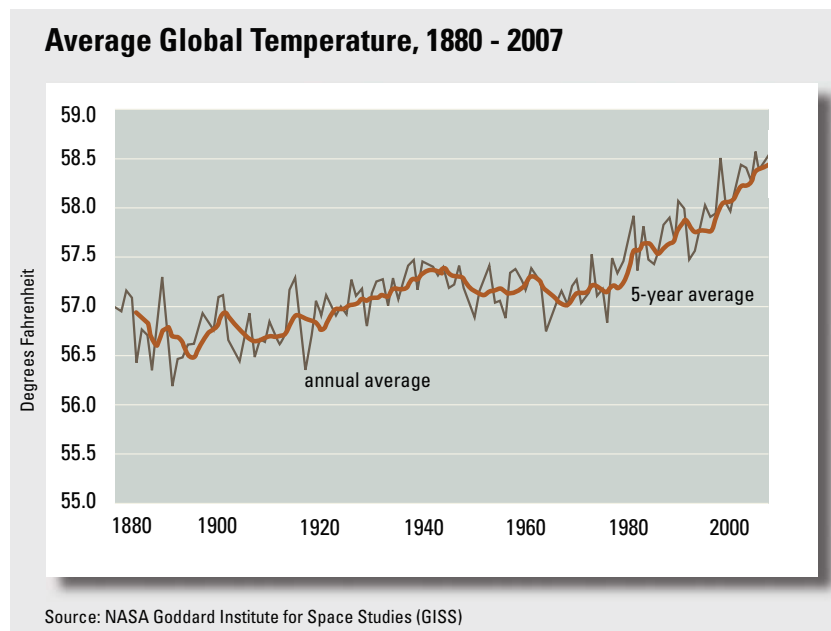


Introduction and Summary

Figure 1



Background

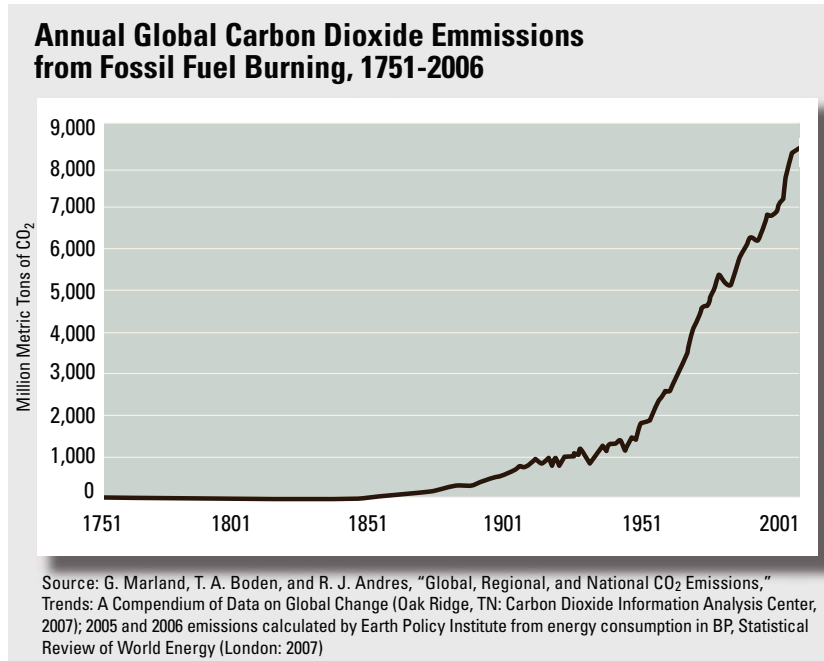
Climate change has become a critical issue affecting the future of Southern California and the entire global community. Assessments from the international and national scientific communities, notably the Intergovernmental Panel on Climate Change (IPCC) and the National Academy of Sciences, have

found that the Earth has been warming at an accelerated pace. In addition to warming temperatures, recent changes in a large number of other measures have been linked to climate change.

Since the beginning of the 20th century, average global temperatures have already risen 1.4° F, with much of the warming occurring within the last 30 years (Figure 1).¹ The year 2005 was Earth's warmest year followed by 2007, and the fourteen warmest years on record have all occurred since 1990. Looking forward, temperatures will likely rise at least another 2° F, and possibly more than 11° F by the end of the 21st century.²

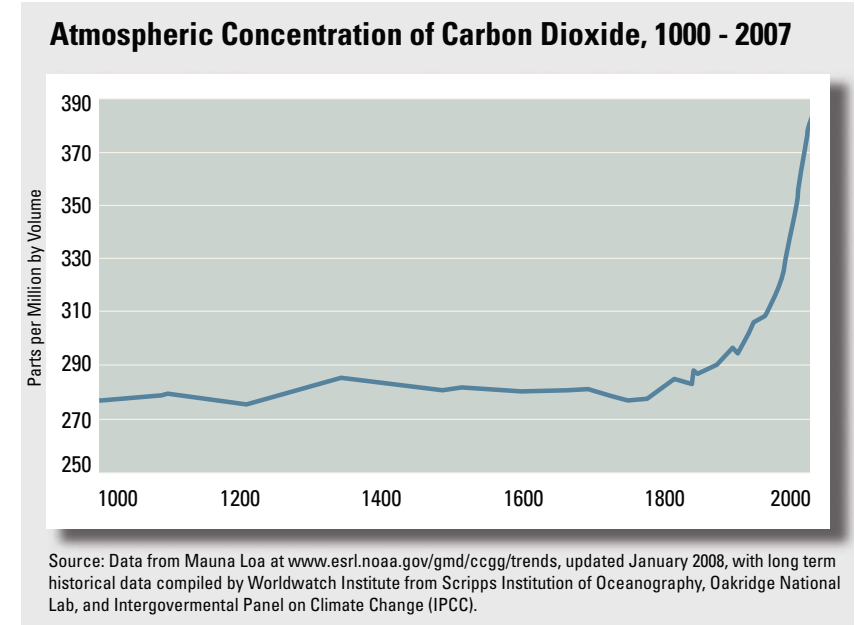
Since the beginning of the Industrial Revolution, increasing greenhouse gas (GHG) emissions due to human activities, particularly the use of fossil fuels, have led to a marked increase in atmospheric GHG concentrations that absorb the heat. These GHGs, predominantly (77 percent) carbon dioxide (CO₂), also include methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆). GHGs are not quickly purged from the atmosphere – CO₂ has a residence time of more than 100 years. So the effects of high GHG emissions on the Earth's climate will be felt for several decades into the future. Between 1750 and 2006, annual global CO₂ emissions from fossil fuel burning increased from 3 million metric tons to 8.4 billion metric tons (Figure 2). In particular, annual global CO₂ emissions from fossil fuel burning since 1950 have increased more than 5 times, from 1.6 billion metric tons to 8.4 billion metric tons.

Figure 2



In 2007, the atmospheric concentration of CO₂ was 384 parts per million (ppm), up from 277 ppm at the start of the Industrial Revolution in 1750 (Figure 3). During the same period, the atmospheric concentration of both methane and nitrous oxide, two other greenhouse gases, also increased significantly due to human activities.³ Between 2000 and 2007, atmospheric CO₂ concentration grew by an average of 2 ppm per year, the fastest seven-year increase since continuous monitoring began in 1959.

Figure 3



Global warming poses a serious threat to the economic well-being, public health and natural environment in Southern California and beyond. The potential adverse impacts of global warming include, among others, a reduction in the quantity and quality of water supply, a rise in sea levels, damage to marine and other ecosystems, and an increase in the incidences of infectious diseases. According to climate scientists, California and the rest of the developed world will have to cut GHG emissions by 80 percent from today's levels to stabilize the amount of GHG emissions in the atmosphere and prevent the most severe effects of global climate change.⁴

California Context

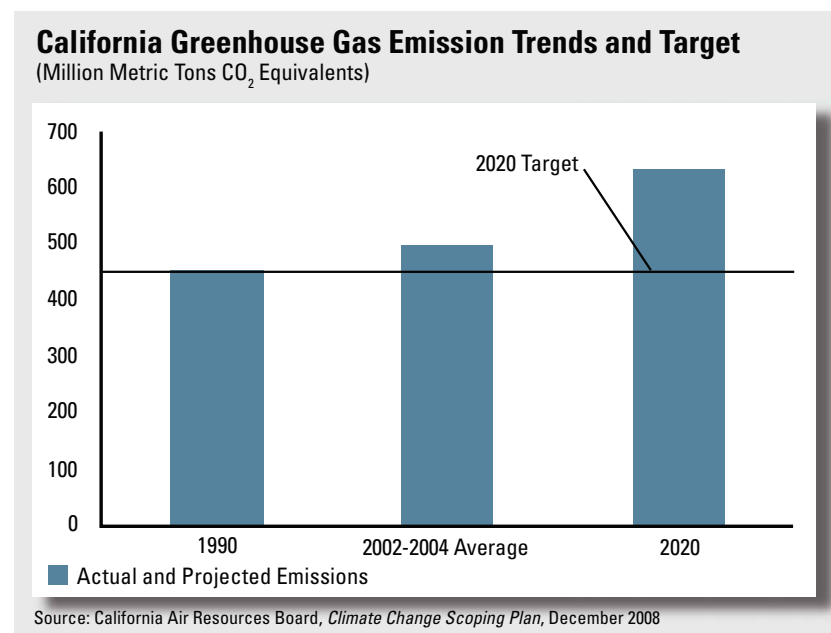
In 1990, California generated 427 million metric tons of CO₂ equivalents (MMTCO₂E) of GHG emissions that increased to reach 469 MMTCO₂E based on the average between 2002 and 2004. It is projected to further increase to 596 MMTCO₂E in 2020 without changes in mitigation efforts. GHG emissions generally track closely with trends in energy use, adjusting for changes in fuel mix and the relative carbon intensity of the various fuels. In 2004, the transportation sector accounted for 38 percent of the total GHG emissions, followed by electricity (23 percent), industry (20 percent), commercial and residential (9 percent), agricultural (6 percent), and others.

California is the most populous state in the nation. Despite its achievement in energy efficiency and less carbon-intensive energy use relative to other states, California is second only to Texas in the nation in terms of total GHG emissions, and is the 15th largest source of climate change emissions in the world, exceeding most nations. The SCAG region, with close to half of the state's population and economic activities, is an important contributor to the global climate change problem and should also be an important contributor to its solution.

In 2006, state legislation Assembly Bill No. 32 (AB 32), the California Global Warming Solutions Act, passed into law requiring that statewide GHG emissions be reduced to 1990 levels by 2020 (Figure 4). This would represent reducing about 30 percent from business-as-usual emission levels projected for 2020. On December 11, 2008, the California Air Resources Board (ARB) adopted a comprehensive Scoping Plan outlining the state's strategy to achieve the 2020 GHG emission reduction target. Senate Bill No. 375 (SB 375), effective January 2009, also intends to implement a small portion of AB 32 to reduce the GHG emissions from

the use of autos and light trucks through land use and related policies. Furthermore, as a long-term goal, Governor's Executive Order (S-3-05) requires that by 2050 reducing the GHG emissions to 80 percent below the 1990 level.⁵

Figure 4



Considerations in Selecting Essay Topics

The scope of the climate change issue is very broad and encompasses planning (e.g. land use, transportation, energy, water, ecosystem and human health), financing, technology, policy, legislation, etc. In addition to state and federal leadership and international cooperation, to effectively address

the climate change challenges requires truly integrated regional planning linked with local implementation.

For this essays publication, the focus is on the scenarios and impacts of climate change in Southern California and potential responses in the region to contribute to the climate change solutions. Because there are many uncertainties involved in so many different aspects of the climate change problem, identifying with confidence a single outcome or pathway is not possible. Thus, it is important to consider a set of possible scenarios. Pertinent scenarios involve not only the range of possible climate changes and their impacts, but also combined impacts with other looming stresses, such as the limit that will be imposed by peak oil that will develop along with an increasingly changing climate. Topics of response strategies covered include integrating land use/transportation planning, green buildings, education and workforce development for a green economy, governance and financing policies, and integration with larger sustainability goals. Most of the response strategies are applicable for local government in the region.

It should be noted that response strategies discussed are illustrative in nature and are not intended to be comprehensive. In addition, they focus on mitigating the potential climate change impacts and not on adaptation strategies. Given certain climate change impacts will be unavoidable, adaptation strategies will also be needed.

Summary of the Essays

The seven issue essays included in this publication address different dimensions of the climate change challenges, solutions and opportunities.

In “What Should Southern California Prepare for?,” Dr. Dan Cayan outlines

the range of climate changes in the region and their potential impacts. He noted that temperature in Southern California by 2100 will likely rise by 4° F, and greater warming, as much as 10° F or more is possible, if greenhouse gas emissions continue at a high rate. Amongst the pervasive effects of climate warming are that the number of days with high ozone conditions will markedly increase. Warmer temperature might require the implementation of additional emission controls in order to offset this climate change. Also, heat waves will likely intensify and last longer.

Southern California’s annual receipt of precipitation is some of the most variable in the world, so we only occasionally see a “normal” year. This volatility, combined with warmer temperatures and a strong possibility of a shift to overall drier conditions, makes us especially vulnerable to climate change. Additionally, Southern California’s water supply challenges will be affected by changes that occur beyond the region in the Sierra Nevada and Colorado River Watersheds. By 2050, sea levels along Southern California’s coast, relative to its 2000 level, could rise as much as one foot, and by 2100 they could rise 1.5 feet to 4 feet above the 2000 level.

Mr. Bryn Davidson’s essay “*Peak Oil and Climate Change: Scenarios and Implications*” focuses on the nexus of climate change, peak oil and planning. Though climate change and peak oil have uncertainties, both were founded on a largely undeniable central message: the future may be very different from the past. Mr. Davidson explores how these two powerful forces might combine to change the way we build our cities and regions. He explains what we know about peak oil (including the growing gap between discovery and consumption). While in the long term, runaway climate change could have many times the impact of peak oil, in the near term (say 1 to 20 years), peak oil’s direct impact on the economy and on the price and availability of energy could be many times the direct local impact of either climate change or climate policy.

Given the uncertainty of both climate change and peak oil, Mr. Davidson defined plausible future scenarios encompassing the combined impacts of peak oil and climate change. In the “Techno-Markets” scenario, the market, after several years of turbulent transition, responds to energy shocks, carbon cap and carbon pricing with new high tech technologies that scale up quickly. In the “Lean and Local” scenario, combined energy, economy, and climate shocks derail both the economy and local concern for climate change. Technological adaptation (to fuel shortages and a more chaotic climate) is limited by the stagnant global economy. Government rationing is common. Local and low tech community-based solutions predominate. These two scenarios are contrasted with the “Past Trend” scenario which embodies many of the assumptions still used by many people today.

The scenario-based planning approach not only identifies the combined impacts of peak oil and climate change but also the policy strategies that would be most robust across scenarios. Those robust strategies must reduce both emissions and oil dependence through resilient investments. By prioritizing these strategies, we can create the backbone of a prosperous post-carbon economy and region.

The first two essays summarized above focus on the impacts and scenarios of climate change and set the stage for the other five essays to address response strategies. In *“How Planning Can Combat Climate Change in Southern California,”* Mr. William Fulton reminds us that we could build on certain trends of the existing development patterns to address climate change. Specifically, we have to take advantage of the emerging pockets of urban concentration in the region, and to reshape certain parts of the region to be less dependent on automobiles.

He gives examples of relatively self-contained villages and dense communities.

The trick is to reinforce these villages and centers so that they have jobs, housing and retail in close proximity to one another – to the extent possible – knit these locations together with high speed public transit in the form of rail lines or bus rapid transit. Mr. Fulton then illustrates some of the tools to accomplish this goal including market opportunities, policy ideas and funding sources. Just as successfully reducing our carbon footprint requires a concentration of activities, successfully bringing these communities into existence requires a dense and focused concentration of policy, funding and marketing efforts.

Mr. Walker Wells addresses the effectiveness of green building programs which have become the cornerstone of climate action plans for local government. In *“Green Buildings – A Tool for Stemming Climate Change?”*, he observes that green buildings integrate innovations in energy efficiency, water conservation, waste management, land use planning and public health. They are a long-term strategy to address climate change and the benefits increase exponentially as time goes by. While new green buildings have attracted the most attention, renovation and operation of existing buildings are also important. In the end, green buildings need to be combined with thoughtful land use planning and provision of resource-efficient transportation options to realize the full potential of the built environment to stem climate change.

Ms. Mona Field illustrates the effort of the Los Angeles Community College District (LACCD) in *“Education for a Green Region: Community Colleges Tackle Climate Change and Economic Development through Green Curriculum and Sustainable Building.”* With the emerging green technology industries, it is important that we train a new generation of workers for a green economy. The District’s green curriculum covers workforce development programs such as architecture, solar installation, alternative fuels, water supply, waste water, and sustainable construction.

In addition, LACCD is undergoing one of the largest public sector sustainable building efforts in the nation, with all new buildings being constructed to meet Leadership in Energy and Environmental Design (LEED™) standards. Also, through a Zero Landfill policy, approximately 98 percent of the District's construction surplus items are kept from reaching local landfills by selling, donating or recycling. Also virtually all of the newly purchased carpeting and furniture procured by LACCD comes from manufacturers who use recycled materials in their products.

Dr. Dan Mazmanian and his colleagues propose a decision-making framework for investment – a triple bottom line – for the region. In *“Governance and Financing Policy in Southern California: Transformative Changes to Achieve Climate Change Goals,”* he proposes that investment should be evaluated based on their performance with respect to the environment, economy and equity. Dr. Mazmanian found that Southern California's unprecedented climate change and energy supply challenges are potentially dire, yet they also provide an opportunity for Southern California to emerge as a national model for how to meet them.

Transformation of existing governance and financing structures will be an essential part of meeting the region's challenges, with lasting benefits in the provision of major infrastructure and public service projects for decades to come. In moving the region forward, it will be essential that a “Triple Bottom Line” (TBL) approach be adopted that combines economic growth, environmental and health safeguards, and an improved quality of life for all the people of the region as the ultimate gauge of the region's prosperity.

In *“Climate Disruptions: Searching for Sustainability in Southern California,”* Dr. Monty Hempel acknowledges that it is too late to stop the climate “train”, but slowing it down is paramount. Southern California will experience the impacts not only from within the region but also through its global

connections. He reminds us that never before has the urgency of a global problem aligned so closely with local transformation. He points out that regional institutional capacities and shared community visions are central to the implementation of “glocal” climate solutions. Actions at the regional and local levels to curb greenhouse gas emissions will have significant co-benefits in contributing to the sustainability of our regional community and beyond for our children and grandchildren.

Finally, to further support implementation activities to address climate change impacts, SCAG staff also prepared two informational pieces to compliment the issue essays. The first piece provides an overview of two climate change legislations in California, AB 32 and SB 375 due to its particular relevance to local government. The other piece provides additional resources on best practices to address climate change.

Endnotes

1. The National Academies. 2008. Understanding and Responding to Climate Change - Highlights of National Academies Reports.
2. Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. p. 13, Cambridge University Press.
3. Ibid, p. 3.
4. California Air Resources Board. 2008. Climate Change Scoping Plan.
5. See Section on “Overview of AB 32 and SB 375” in this publication for additional background information.